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ORIGINAL ARTICLE

Different sling procedures for stress urinary incontinence: A lesson from 453 patients

De-Yi Luo, Kun-Jie Wang, Han-Chao Zhang, Yi Dai, Tong-Xing Yang, Hong Shen*

Department of Urology, West China Hospital, Sichuan University, Chengdu, Sichuan, PR China

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Abstract Several midurethral sling (MUS) procedures, such as tension-free vaginal tape (TVT), TVT obturator (TVT-O), tension-free vaginal tape SECUR (TVT-S), and pubovaginal sling (PVS), have been used for the treatment of female stress urinary incontinence (SUI); however, which method is best for a particular patient group is not known. This study aimed to identify the best rationale for choosing the optimal MUS procedure for each patient. In total, 453 consecutive female patients with SUI who were treated with MUSs in West China Hospital of Sichuan University from September 2003 to September 2011 were enrolled in this study. All the patients underwent comprehensive pre-, intra-, and postoperative evaluations, including collection of demographic information, pelvic examination, and urodynamic testing, and operation-related complications were recorded. The Incontinence Quality of Life questionnaire was also completed. Under local or general anesthesia, 105 cases were treated with TVT, 243 with TVT-O, 90 with TVT-S, and 15 with PVS. Patients with different profiles in terms of age, symptom duration, concomitant procedures, urodynamic parameters, and pelvic organ prolapse (POP) quantification score were treated successfully; the body mass index did not differ significantly among the various treatment options. The cure and improvement rates were similar among the treatment groups: 97.14% (102/105) in TVT, 100% (243/243) in TVT-O, 98.89% (89/90) in TVT-S, and 100% (15/15) in PVS. Only minor complications were experienced by the patients. In conclusion, each MUS procedure was observed to be safe and effective in different subpopulations of patients, and the results suggest that appropriate patient selection is crucial for the success of each MUS procedure.

* Corresponding author. Department of Urology, West China Hospital, Sichuan University, Guoxue Xiang Number 37, Chengdu, Sichuan 610041, PR China.
E-mail address: shen1177hx@163.com (H. Shen).

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Introduction

Stress urinary incontinence (SUI) is a common health problem, with the prevalence rate ranging from 12.8% to 46.0%. SUI has a major impact on the quality of life (QOL) of many women, and it represents a major economic burden globally [1]. Various therapeutic options are available to alleviate this problem, and surgical correction is used for women with SUI in whom conservative management strategies have failed [2].

The midurethral sling (MUS) is the most commonly performed surgical treatment and has been considered as a gold standard for treating patients with SUI [3]. The pubovaginal sling (PVS) was described in the early 20th century and was brought into wide clinical use by Drs E.J. McGuire and B. Lytton in the late 1970s [4]. Thereafter, the tension-free vaginal tape (TVT) procedure was developed in 1996 by Dr U. Ulmsten and colleagues [5]. In 2001, Dr E. Delorme [6] introduced the outside-in transobturator tape (TOT) method, in which the needle is penetrated through the skin to the vaginal anterior wall, and in 2003, Dr J. de Leval [7] described the inside-out TVT-obturator (TVT-O) method. In an attempt to minimize postoperative complications further and reduce the need for anesthesia, single-incision slings, such as tension-free vaginal tape SECUR (TVT-S), have been developed.

Therefore, a broad spectrum of options exists for patients with SUI who undergo surgical treatment. However, in clinical practice, choosing the most appropriate sling therapy for treating different groups of SUI patients is challenging. The objective of this study was to summarize the associations between patient conditions and the MUS procedure chosen. Here, we reported the patient conditions that are considered most appropriate for each MUS procedure, including TVT, TVT-O, TVT-S (Johnson & Johnson Medical (China) Ltd, Shanghai, China), and PVS, to ensure the best outcome.

Materials and methods

Design

The study was a retrospective cohort analysis and was approved by the hospital ethics committee. Patient data were collected from the database of the Urology Clinic at West China Hospital, Sichuan University (Chengdu, Sichuan, P.R. China), from September 2003 through September 2011. All these patients underwent TVT, TVT-O, TVT-S, or PVS to treat SUI.

Participants

Female patients aged 18—85 years who had SUI or mixed urinary incontinence (MUI) and underwent treatment with a sling procedure were enrolled. Patients with pure urge incontinence, overflow incontinence, or continuous incontinence due to a neurological deficit and those with poorly controlled diabetes and vaginal or urinary tract infection were excluded from this study.

Procedure

All the procedures were performed by a single surgeon (H.S.). During this study, the TVT technique used was similar to that described previously by Ulmsten et al. [5], the TVT-O technique was similar to that described by de Leval [7], and the TVT-S technique was similar to that described by Neuman [8].

The surgical technique for PVS was similar to that described in the literature [9]. Briefly, the bladder neck was exposed transvaginally, and PVSs 8—10 cm in length were harvested from the anterior rectus sheath and suspended using a zero polyglactin suture with a Kocher clamp that was passed from the abdominal incision into the retropubic space and out from the vaginal incision. The suture was finally pulled up into the abdominal incision. Cystoscopy was performed to confirm no injury to the bladder or urethra. The sling was sutured in place in the midline to the bladder neck, and the sutures were then tied with no tension over the rectus fascia. Incisions were closed using absorbable sutures, and a Foley catheter was left in place.

Assessments

Baseline evaluations, including patient demographics, medical and surgical histories, pelvic examination, and urodynamic testing, were conducted. At the pretreatment and 12-month postoperative visits, all the patients completed the Chinese-translated forms of both the Incontinence Quality of Life (I-QOL) questionnaire [10] and the Incontinence Visual Analogue Scale (I-VAS; 0, no incontinence; 10, extremely severe incontinence). The Pelvic Organ Prolapse Quantification System [11] was used for pelvic examination. At the beginning of the pelvic examination, patients with a full bladder had a cough or Valsalva leak test in the supine position. If there was no leak, the test was repeated in the sitting and standing positions. If there was any amount of urinary leakage during the test, the patient was diagnosed with clinical SUI. Urodynamic testing was performed according to the International Continence Society standards [12].

Surgical results were evaluated 1 year postoperatively by the cough stress test with a full bladder and symptom questionnaire. The outcome of surgical treatment was divided into three categories: cured, improved, and failed. "Cured" indicated that patients had a negative cough stress test and no urine leakage during stress. "Improved" indicated that the patients had no urine leakage in the cough stress test but may experience occasional urine leakage during stress; occasional leakage neither influenced daily-life activities nor required any further treatment. "Failed" indicated that the patients had urine leakage in both the cough stress test and during stress. At 1 year postoperatively, the patients were asked to classify their global satisfaction level as very satisfied, satisfied, or dissatisfied. Both "very satisfied" and "satisfied" were considered to indicate satisfied.

Operation time (from incision to closure), estimated blood loss (calculated as the total volume to the volume of prefilled water in the suction chamber), and perioperative complications were recorded.

Statistical analysis

A statistical analysis was performed using SPSS version 17.0 for Windows (SPSS Inc., Chicago, IL, USA). Continuous

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variables were presented as the mean ± standard deviation (SD), whereas categorical data were represented as the number and percentage of all the patients. Nonparametric data were presented as the median and interquartile range. A descriptive analysis of each study variable was performed, and postoperative changes were analyzed using the paired *t* test or Wilcoxon signed rank test. Continuous or ordinal variables were compared between the four methods using a one-way analysis of variance or the Wilcoxon Mann–Whitney test according to the normality of the distribution. Categorical variables were compared using the Chi-square test/Fisher exact test. Nonparametric data gathered using the I-QOL questionnaire were compared using the Kruskal–Wallis test. The Bonferroni correction was applied where necessary. Statistical significance was considered at $p < 0.05$ in all statistical analyses.

Results

In total, 453 consecutive female patients with SUI underwent a sling procedure and were enrolled retrospectively. The patients were divided into four groups according to the sling procedure as follows: TVT ($n = 105$), TVT-O ($n = 243$), TVT-S ($n = 90$), and PVS ($n = 15$) groups. Patient conditions and preoperative data are summarized in Table 1. Age, symptom duration, percentage of patients with a concomitant procedure, urodynamic parameters, and POP quantification score were significantly different among the groups ($p \leq 0.0139$). The body mass index (BMI) was 21.8 ± 2.6 kg/m^2 in this population of SUI patients and did not differ significantly among the groups ($p = 0.1822$).

Results of the I-QOL questionnaire are shown in Table 2. Statistical significance was observed in pre- and postoperative QOL scores of the four groups ($p < 0.001$). The total score and scores of all three individual domains were improved significantly at the postoperative evaluation compared to baseline in all four groups ($p < 0.05$). The postoperative improvement in total score was greatest in the TVT group. In the preoperative evaluation, the TVT-S group had the highest QOL score, whereas the PVS group exhibited the lowest QOL score. Additionally, the patients in the PVS group demonstrated the highest I-VAS, whereas those in the TVT-S group exhibited the lowest I-VAS.

As shown in Table 3, under local or general anesthesia, the mean operation time for the four groups was significantly different ($p < 0.001$): TVT, 46.3 minutes (range, 30–60 minutes); TVT-O, 31.2 minutes (range, 25–45 minutes); TVT-S, 7.9 minutes (range, 7–15 minutes); and PVS, 101.6 minutes (range, 90–150 minutes). The operation time for TVT-S was significantly shorter when compared with TVT, TVT-O, and PVS.

The average amount of blood loss during the operation also differed significantly ($p < 0.001$) among the four groups: TVT, 35.4 mL (range, 30–50 mL); TVT-O, 23.2 mL (range, 15–30 mL); TVT-S, 12.0 mL (range, 5–20 mL); and PVS, 81.2 mL (range, 50–100 mL). The patients neither suffered any adverse sequelae due to blood loss nor warranted any treatment. As a routine procedure, a urine catheter was maintained after each surgical procedure. The postoperative indwelling catheterization time differed significantly among the groups ($p < 0.001$): 1–4 days for TVT, 1–3 days for TVT-O, 1–2 days for TVT-S, and 5–49 days for PVS. All patients who underwent PVS were recommended to receive clean intermittent catheterization until they could void normally, and the longest duration of clean intermittent catheterization was 49 days. Difficulty in voiding was not observed after the removal of the catheter.

Intra- and postoperative complications are shown in Table 3. Bladder perforation was observed only in one patient during the TVT procedure. No urethral or vessel lesion was found intraoperatively. Additionally, hematoma and mesh tape exposure were not observed postoperatively. *De novo* overactive bladder symptoms such as frequency, urgent urination, and urge incontinence were found in three patients with TVT (2.86%), five patients with TVT-O (2.06%), two patients with TVT-S (2.22%), and one patient with PVS (6.67%), and all these patients showed improvement after the administration of anticholinergic agents. Urinary tract infection was not observed in the TVT-S group postoperatively, and its rate ranged from 0.41% to 13.33% in the remaining three groups.

At the follow-up examination, the rate of cure and improvement in patients was 95.14% (431 of 453) in the entire cohort, 97.14% (102/105) for TVT, 100% (243/243) for TVT-O, 98.89% (89/90) for TVT-S, and 100% (15/15) for PVS, according to the assessment standard. No patients were categorized as having a failed procedure in either the TVT-O or the PVS group. As observed in Table 4, based on the patient self-report of surgical satisfaction, 89.52% of TVT patients were "very satisfied" or "satisfied" with the surgical procedure; this number was significantly higher in the other three groups: 98.77% in the TVT-O group, 95.56% in the TVT-S group, and 100% in the PVS group.

Discussion

Sling surgery is considered the gold standard for the treatment of SUI [3]. The placement of slings is technically easy, the operation time is short, and the frequency of complications is low. Most importantly, the cure rates of slings are between 70% and 90%, and they remain stable over time [13].

However, there is no consensus about whether a single best surgery exists for all patients with all conditions. Many factors should be considered when choosing the appropriate operation for SUI in an individual patient for ensuring a favorable outcome or minimizing the risk of a poor outcome or associated complications. The present study identified important factors to consider when choosing among the four sling procedures.

Since 2003, sling procedures, including TVT, TVT-O, TVT-S, and PVS, have been used to treat patients with SUI in our department, and we have selected different types of sling procedures for different patients according to age, symptom duration, percentage of women with a concomitant procedure, urodynamic parameters, and POP quantification score, which have been found to differ significantly between these groups. In the present study, the cure rate was 95.14% for the entire cohort, although one of the limitations of this investigation is the relatively small number of patients in the PVS group.

The effect of age on the outcomes of sling surgery is relatively undefined. Hellberg et al. [14] have reported a cure rate of 56% for patients aged > 75 years compared

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Table 1 Preoperative characteristics of patients in TVT, TVT-O, TVT-S, and PVS groups.

Variables	TVT (n = 105)	TVT-O (n = 243)	TVT-S (n = 90)	PVS (n = 15)	p*
Age (y)	53.9 ± 14.1 (18–80)	51.1 ± 9.1 (33–82)	52.4 ± 10.7 (25–69)	45.3 ± 7.2 (39–58)	0.0139
BMI (kg/m^2)[a]	24.1 ± 2.0 (22.1–26.0)	20.4 ± 2.6 (17.5–22.4)	20.2 ± 2.2 (18.1–22.4)	22.7 ± 2.3 (20.6–25.2)	0.1822
Symptom duration (y)	15.2 ± 13.6 (0.5–50)	6.4 ± 6.2 (0.5–35)	8.3 ± 8.2 (0.2–20)	21.7 ± 14.0 (3–32)	<0.0001
Incontinence type					
Pure stress	80 (76.2)	181 (74.5)	63 (70)	8 (53.3)	
Mixed	25 (23.8)	62 (25.5)	27 (30)	7 (46.7)	
Concomitant procedure	5 (4.8)	26 (10.7)	2 (2.2)	3 (20)	<0.0001
Anterior Prolift pelvic floor repair	0	14 (5.8)	2 (2.2)	0	
Total Prolift pelvic floor repair	5 (4.8)	6 (2.5)	0	0	
Perineal laceration repair	0	6 (2.5)	0	0	
Urethral reconstruction	0	0	0	3 (20)	
Urodynamic parameters					
VLPP (cmH_2O)	38.8 ± 19.1 (19–100)	71.5 ± 17.5 (30–105)	88.0 ± 16.4 (30–100)	31.3 ± 19.0 (20–50)	<0.0001
MUCP (cmH_2O)	31 ± 7.6 (20–40)	45 ± 10 (25–60)	84 ± 25.5 (40–120)	15 ± 4.3 (10–20)	<0.0001
Pelvic organ prolapse quantification score (cm)					
Ba	−1.9 ± 1.0	−3.2 ± 0.5	−2.8 ± 1.3	−1 ± 0.8	<0.0001
Bp	−2.3 ± 1.0	−3.5 ± 0.6	−4.0 ± 0.9	−2 ± 1.1	<0.0001
C	−5.2 ± 3.5	−6.7 ± 1.0	−7.1 ± 2.8	−4 ± 3.2	<0.0001

Data are presented as n(%) or mean ± SD.
* Comparison among four surgery groups, significant at <0.05.
Ba = most descendant point of anterior vaginal wall; BMI = body mass index; Bp = most descendant point of posterior vaginal wall; C = most descendant point of cervix or cuff; MUCP = maximum urethral closure pressure; PVS = pubovaginal sling; SD = standard deviation; TVT = tension-free vaginal tape; TVT-O = tension-free vaginal tape obturator; TVT-S = tension-free vaginal tape-SECUR; VLPP = Valsalva leak-point pressure.
[a] BMI was calculated from the patients' height and body weight records.

Table 2 Pre- and postoperative scores on short forms of I-QOL and I-VAS among four surgery groups.

	TVT		TVT-O		TVT-S		PVS		p**
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	
I-QOL total	64.1 (61.4, 73.5)	91.6 (84.7, 94.1)*	65.6 (60.2, 71.1)	91.1 (85.3, 95.6)*	70.3 (62.4, 75.5)	92.0 (86.4, 94.9)*	59.1 (53.1, 62.3)	82.8 (75.9, 87.9)*	<0.001
ALB	65.4 (62.9, 79.4)	93.1 (85.6, 95.1)*	64.3 (59.1, 72.5)	93.7 (83.4, 100.0)*	69.2 (61.1, 75.6)	85.6 (81.5, 98.7)*	57.4 (50.1, 70.4)	73.8 (71.2, 93.6)*	<0.001
PS	60.2 (57.1, 70.2)	86.5 (80.2, 95.6)*	70.9 (58.8, 73.2)	85.6 (81.0, 100.0)*	78.1 (70.2, 82.3)	91.7 (84.2, 100.0)*	55.6 (50.2, 64.5)	82.3 (70.5, 87.9)*	<0.001
SE	59.3 (53.2, 66.6)	91.3 (85.7, 100.0)*	61.1 (55.7, 68.3)	94.3 (83.5, 100.0)*	63.8 (60.0, 70.9)	94.2 (85.2, 100.0)*	60.2 (53.3, 68.2)	84.5 (70.0, 92.1)*	<0.001
I-VAS	6.8 ± 2.3	1.3 ± 0.4	6.5 ± 1.6	1.2 ± 0.7	5.8 ± 1.8	1.1 ± 0.4	7.5 ± 2.1	1.4 ± 0.6	<0.001

*$p < 0.05$; comparison between pre- and postoperative scores in each group, using Wilcoxon signed rank test or paired t test with Bonferroni correction with $\alpha = 0.013(0.05/4)$.
**The p values are based on Kruskal–Wallis test; a comparison between pre- and postoperative scores of four surgery groups. Mann–Whitney tests for multiple comparisons adjusted by Bonferroni test.
ALB = avoidance and limiting behavior; I-QOL = Incontinence Quality of Life questionnaire; I-VAS = Incontinence Visual Analogue Scale; PS = psychosocial impacts; SE = social embarrassment; PVS = pubovaginal sling; TVT = tension-free vaginal tape; TVT-O = tension-free vaginal tape obturator; TVT-S = tension-free vaginal tape-SECUR.

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Table 3 Operation-related complications and morbidity in four groups.

Category	TVT	TVT-O	TVT-S	PVS	p^*
Operative time (min)	46.3 ± 5.8 (30, 50)	31.2 ± 4.9 (25, 45)	7.9 ± 3.2 (7, 15)	101.6 ± 9.5 (90, 150)	<0.001
Intraoperative bleeding (mL)	35.4 ± 4.3 (30, 50)	23.2 ± 7.1 (15, 30)	12.0 ± 4.1 (5, 20)	81.2 ± 16.3 (50, 100)	<0.001
Catheterization time (d)	2.5 ± 1.1 (1, 4)	2.1 ± 0.8 (1, 3)	1.1 ± 0.6 (1, 2)	10.8 ± 6.4 (5, 49)	<0.001
Hospital stay (d)	3.8 ± 2.2 (3, 7)	2.9 ± 1.8 (2, 7)	1.2 ± 0.5 (0.5, 2)	8.4 ± 5.1 (7, 14)	<0.001
Operative complications					
Bladder perforation	1 (0.95)	0	0	0	<0.001
Hematoma	0	0	0	0	
Transfusion	0	0	0	0	
Fever	1 (0.95)	0	0	2 (13.33)	<0.001
Postoperative *de novo* urgency	3 (2.86)	5 (2.06)	2 (2.22)	1 (6.67)	<0.001
Urinary tract infection	2 (1.90)	1 (0.41)	0	2 (13.33)	<0.001
Mesh tape exposure	0	0	0	0	

Data are presented as *n*(%) or mean ± SD.
*Comparison among four surgery groups, significant at <0.05.
PVS = pubovaginal sling; SD = standard deviation; TVT = tension-free vaginal tape; TVT-O = tension-free vaginal tape obturator; TVT-S = tension-free vaginal tape-SECUR; VLPP = Valsalva leak-point pressure.

with 80% for those aged < 75 years, whereas Gordon et al. [15] demonstrated similar cure rates at 12 months in younger (mean age 57.8 years) and older (mean age 74.9 years) patients who received TVT. In the present study, all the patients aged >70 years were counseled to undergo the TVT procedure rather than the TVT-O or TVT-S procedure. Despite controversy regarding age and its impact on sling procedure outcomes, age is not a contraindication [16]. If the patient is young and nulliparous, it is reasonable to advise her to postpone surgery until after her last pregnancy. Moreover, it may be optimal to perform the sling procedure under local anesthesia with conscious sedation for an elderly patient with multiple comorbidities.

It is well known that SUI in women is associated with higher BMI and greater weight [17]. However, the evidence regarding the role of BMI in the outcomes of sling surgery is inconsistent [18,19]. One preliminary study has indicated that TVT is a more effective surgery for SUI compared with the laparoscopic Burch procedure in obese patients [18]. Nevertheless, BMI has not been investigated as an independent variable or risk factor for failure in a randomized fashion between two different SUI procedures. Therefore, no definitive recommendations can be given to patients in this regard. Our study demonstrated no significant difference in BMI among the four surgery groups, suggesting that BMI may not be a risk factor for failure or decreased efficacy following sling procedures. Additional studies, including prospective randomized trials with longer follow-up periods, will be required to confirm these findings.

MUI is the coexistence of SUI and urgency urinary incontinence. Several studies have shown that patients with MUI may have lower cure rates after surgery than those with pure SUI [20]. In the present study, the patients with MUI underwent a trial of medical and behavioral therapy prior to surgical treatment because one-third of patients with MUI are expected to become dry with conservative therapy alone [21]. In this study, for patients with persistent incontinence after a trial of conservative therapy, surgery was recommended after appropriate patient counseling. One systematic review including patients with MUI has reported that the odds of overall subjective cure are similar for TVT and TVT-O [22]. We were unable to

Table 4 Surgical results in patients with TVT, TVT-O, TVT-S, and PVS.

Category	TVT	TVT-O	TVT-S	PVS	*p*
Success parameters					
Cured	96 (91.43)*,**,***	235 (96.71)***	86 (95.56)***	14 (93.33)	<0.001
Improved	6 (5.71)*,**	8 (3.29)***	3 (3.33)***	1 (6.67)	<0.001
Failed	3 (2.86)*,**,***	0**	1 (1.11)***	0	<0.001
Subjective satisfaction					
Very satisfied	60 (57.14)*,**,***	154 (63.37)***	57 (63.33)***	4 (26.67)	<0.001
Satisfied	34 (32.38)***	86 (35.39)***	29 (32.22)***	11 (73.33)	<0.001
Not satisfied	11 (10.48)*,**,***	3 (1.23)***	4 (4.44)***	0	<0.001

Data are presented as *n*(%).
* Significantly different compared with TVT-O.
** Significantly different compared with TVT-S.
*** Significantly different compared with PVS.
PVS = pubovaginal sling; TVT = tension-free vaginal tape; TVT-O = tension-free vaginal tape obturator; TVT-S = tension-free vaginal tape-SECUR; VLPP = Valsalva leak-point pressure.

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determine the superiority of one sling procedure for MUI in the current study because patients in each sling group were significantly different in terms of preoperative demographics. However, in patients with MUI symptoms, we would like to recommend TVT-O, as our data demonstrate that TVT-O has the lowest rate of postoperative *de novo* urgency (2.06%) compared with the other three sling procedures. In addition to our observation, one study has suggested that the transobturator approach has a lower rate of postoperative urgency and urge incontinence than the retropubic approach [3].

In all major national and international guidelines from both gynecological and urological scientific societies, urodynamic testing is advised to be performed prior to invasive treatment for SUI. Even then, the extent to which urodynamic evaluation impacts the choice or outcome of surgery remains controversial [23]. Some studies have indicated that women with reduced maximum urethral closure pressures (MUCPs) have poorer outcomes after surgery [24] and suggested that women with low closure pressures may benefit from a more obstructive type of surgery. In this study, the mean MUCP was 31 $\pm$ 7.6 cmH_2O (range, 20–40 cmH_2O) in the TVT group, 45 $\pm$ 10 cmH_2O (range, 25–60 cmH_2O) in the TVT-O group, 84 $\pm$ 25.5 cmH_2O (range, 40–120 cmH_2O) in the TVT-S group, and 15 $\pm$ 4.3 cmH_2O (range, 10–20 cmH_2O) in the PVS group (Table 1). SUI patients who underwent TVT or PVS demonstrated a Valsalva leak point pressure (VLPP) of less than 60 cmH_2O. For those who underwent TVT-O or TVT-S, the VLPP was greater than 60 cmH_2O (Table 1). Other data indicate that preoperative VLPP has no bearing on outcomes after treatment for SUI using a sling procedure [25]. However, it has been suggested that patients who demonstrate a low leak point pressure ($<$60 cmH_2O) or low MUCP ($<$20 cmH_2O) are associated with a higher risk of surgical failure with the TVT-O approach compared with the PVS or TVT approach [26], and our data demonstrated a patient cure rate of 100% (15/15) for the PVS group. Therefore, with all other factors being equal, it is reasonable to treat patients with intrinsic sphincter deficiency using PVS, which is more obstructive. However, some authors suggest that patients with lower MUCPs have better outcomes with the retropubic approach (TVT) [27].

Whether a concomitant SUI procedure should be performed in all, some, or no patients undergoing POP repair is under debate. However, Lee et al. [28] have recently reviewed the literature about the efficacy and safety of using sling procedures for patients with SUI who are also undergoing prolapse repair. Their review suggested that TVT, TVT-O, and PVS are effective and safe for the treatment of SUI with concurrent prolapse repair, with no difference in the expected cure rate compared with patients with isolated SUI. Therefore, in women with SUI (who demonstrated a positive stress test) who underwent POP surgery, we performed the sling procedure concurrent with the POP surgery, and we believe that TVT-O is often preferable.

Given the complex, multifactorial pathophysiology of SUI and the spectrum of severity, it is unlikely that any single operation currently utilized will be applicable to all patients with SUI and will be accepted as such universally [29]. However, some factors must be considered to guide the choice of surgical procedure for the treatment of SUI in individual patients [30], even though the evidence supporting the effects of these factors is generally weak. Moreover, the surgical choice of sling procedure may also be dependent on the surgical experience of a surgeon and the patient's preference. As such, these factors should be used for patient counseling to ensure that the benefits outweigh any possible complications and that the patient goes home and remains satisfied with the procedure [29].

In conclusion, sling procedures (TVT, TVT-O, TVT-S, and PVS) are safe and reproducibly effective. However, no single sling procedure is universally successful for any of the different conditions associated with SUI. To maximize success and minimize the risk of complications, factors such as age, incontinence type, urodynamic parameters, personal experience, and preferences of the surgeon and patient should be considered when choosing a suitable sling procedure for an individual patient with SUI.

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